I claim:

1. An apparatus for processing data derived from the weight of the load carried by the body of a truck, said apparatus comprising:

a truck frame including an assembly for supporting said truck body ~~between~~ on said frame;

a pressure sensor assembly mounted to said frame for transferring from said body to said frame at least a predetermined portion of the total weight of said body such that said assembly distributes to said frame said predetermined portion of the total weight in a substantially uniform manner along an interface between said truck frame and body and said assembly is responsive to said predetermined portion of the total weight to provide pressure data representative of the weight of said truck body; and

a processor means for receiving said pressure data and detecting a change in the weight of said truck body and formulating data indicative of truck condition in response to said pressure data and its change.

2. An apparatus as set forth in claim 1 wherein said processor means includes 1) memory means for storing data indicative of a predetermined maximum weight capacity for said truck body, 2) detection means responsive to incremental increases in the total weight of said truck body for determining the approximate weight of material added by a bucket of a loader, 3) comparison means responsive to said memory, processor and detection means for determining if the total weight minus said predetermined maximum weight for said truck body is a fraction of the approximate weight of material in said bucket, and 4) display means responsive to said comparison means for displaying the remaining weight capacity of said truck body.

3. An apparatus as set forth in claim 2 wherein said detection means includes;

first means for detecting a monotonic increase in the total weight of said truck body; and

second means for storing said increase.

4. An apparatus as set forth in claim 2 wherein said processor means includes means for isolating pressure data representing pressure spikes and means for recording the occurrence of a pressure spike, and means responsive to the recording means for delivering data to said display means indicative of the degree of road roughness.

5. An apparatus as set forth in claim 2 wherein said display means includes a display of the remaining weight capacity of said truck body as a percentage of the approximate weight of material carried by said bucket.

6. An apparatus as set forth in claim 5 wherein said display means comprises a series of light indicators representative of the approximate capacity of a bucket, said light indicators being relatively positioned such that each light represents a fractional portion of the capacity of the bucket.

7. An apparatus as set forth in claim 2 wherein said pressure sensor assembly is also a cushioning interface between said truck body and said truck frame.

8. An apparatus as set forth in claim 2 wherein said body is pivotally mounted to said frame by way of a hinge assembly such that said pressure sensor assembly supports the entire weight of said truck body in its lowered position on said truck frame along the interface between said truck frame and body with none of the weight of the load transferred to the truck frame via said hinge assembly.

9. An apparatus as set forth in claim 8 wherein said hinge assembly has body and frame portions and also has means for decoupling said body and frame portions when said truck body is moved to its lowered position such that the entire weight of said truck body is communicated to said truck frame through said pressure sensor assembly.

10. An apparatus as set forth in claim 1 wherein said pressure sensor assembly comprises at least one length of resilient tubing positioned on a beam of said truck frame wherein said resilient tubing provides an interface between said truck body and said truck frame for communicating said at least predetermined portion of the weight of said body to said frame.

11. An apparatus as set forth in claim 1 including:

first transceiver means mounted to each of said plurality of trucks;

said processor means mounted to said truck and said processor means operatively coupled to said first transceiver means and said pressure sensor assembly for receiving said data from said pressure sensor assembly, processing said data and transmitting data signals indicative of the truck's hauling status by way of said transceiver; and

a stationary processor means including second transceiver means for communicating with said first transceiver means, said stationary processor means receiving said data signals from said processor means, said data signals identifying the truck and its hauling status.

12. An apparatus as set forth in claim 11 wherein

said stationary processor means includes 1) first means for calculating in response to said data signals an average

load time for each loader, 2) second means responsive to said data and said first means for calculating the current load delay time for each loader, 3) third means for identifying the loader with the minimum load delay 4) fourth means for forming data for transmission by said second transceiver means, said data identifying a particular truck and the loader with the minimum load delay time; and

said processor means mounted to said truck including fifth means responsive to data received from said fourth means by said first transceiver for displaying the number of the loader identified by the data to the operator of the truck identified by the data.

13. An apparatus as set forth in claim 11 wherein said pressure sensor assembly includes tubings which forms the interface between each of said body and frame of said trucks.

14. An apparatus as set forth in claim 11 wherein said stationary processor means includes memory means for archiving data from said trucks.

15. An apparatus as set forth in claim 11 wherein said processor means generates data signals for transmission in response to said data from said pressure sensor assembly which are indicative of whether said truck is dumping its load, beginning loading of a new load or in transit between load and dump sites.

16. An apparatus as set forth in claim 15 wherein said processor means generates data signals for transmission in response to data a plurality of sensors on-board said trucks including gear sensors, dump sensors and distance sensors.

17. An apparatus as set forth in claim 11 wherein said stationary processor means includes memory means for

archiving said data signals from each of said plurality of processors in groups firstly identifiable with individual trucks and secondly identifiable with types of trucks.

18. An apparatus as set forth in claim 17 wherein the data base formed by the data archived in said memory means is used by said stationary processor means to generate data for controlling the movement of said truck by transmitting said control data for reception by said first transceiver.

19. An apparatus as set forth in claim 1 wherein said processor means includes:

means for periodically sampling the pressure data from said pressure sensor assembly;

storing said data;

means for periodically comparing a selected one of said data samples with other stored samples to determine if said one of said data samples is a pressure spike;

means for counting the pressure spikes; and

means for deriving from the total count of pressure spikes an indication of the degree of road roughness and displaying said indication on display means.

20. An apparatus as set forth in claim 1 including:

said processor means providing an indication of a load or dump condition of said truck in response to pressure data from said pressure sensor assembly;

distance means for measuring the distance traveled by said truck between load and dump indications from said processor means;

storage means responsive to said distance means and said pressure sensor assembly for storing the distance traveled by said truck between load and dump sites and for storing the total weight of the load hauled by said truck between sites; and

means responsive to the storage means for multiplying the distance traveled by the weight hauled in order to provide a tons·miles record.

21. An apparatus as set forth in claim 20 incuding, means for transmitting to a remote location the value resulting from the multiplying means where the value is divided by the time interval between successive load and dump indications thereby providing a standard for the degree of tire load.

22. An apparatus according to claim 1 wherein said apparatus identifies a reference number and records vital statistics of the truck in connection with said reference number, said apparatus includes:

memory means operatively coupled to said processor means;

means coupled to said processor means for entering said reference number and for identifying a portion of said memory means corresponding to said reference number;

said processor means responsive to said pressure data for 1) manipulating said data and 2) routing said manipulated data to locations within said portion of said memory identified by said entering means;

detecting means responsive to said entering means for detecting changes in the reference number; and

display means responsive to said detecting means for displaying the manipulated data in said portion of memory when a change of said reference number has occurred.

23. An apparatus according to claim 11 including:

said stationary processor means including memory means for storing a predetermined maximum load capacity for each of said truck bodies; and

said processor means including means for determining a weight of said truck body from the data of said pressure sensor assembly indicative of the weight of the load, each of said processor means transmitting data to said stationary process or means which is indicative of the total weight of the truck body,

said stationary processor means 1) comparing the weight with the predetermined maximum load capacity, and 2) generating an output signal identifying the truck if the weight is greater than the predetermined maximum load capacity.

24. An apparatus as set forth in claim 1 including means for displaying the weight of said truck body in response to said processor means.

25. An apparatus as set forth in claim 23 including means in said stationary processor means for accumulating the total number of times an output signal is generated indicating an overload of the truck.

26. An apparatus as set forth in claim 1 including means for measuring the front and rear axle loads of said truck wherein said body is pivotally mounted to said frame, said means comprising:

a weighing device on said truck distinct from said pressure sensor assembly for measuring a force of said truck body on said truck frame and providing data indicative of said force;

a processor means responsive to the data from said weighing device and said pressure sensor assembly for determining the distribution of the weight of said truck body over the front and rear axles of said truck; and

display means responsive to said processor means for displaying the portions of the weight of said truck body carried by said front and rear axles.

27. An apparatus as set forth in claim 26 wherein hydraulic cylinders connected between said truck frame and body move said truck body between said raised and lowered positions, said weighing device sensing the pressure in the hydraulic fluid of said hydraulic cylinder.

28. An apparatus as set forth in claim 26 wherein said processor means includes means for finding the relative location of the center of gravity of a loaded truck body between said front and rear axles.

29. An apparatus as set forth in claim 26 wherein said processor means includes memory means storing predetermined tare weights for said front and rear axles and said processor means including summing means for adding the axle weight to the tare weight in order to find a gross weight for each axle.

30. An apparatus as set forth in claim 1, wherein said truck body is pivotal between raised and lowered positions on said truck body and where said pressure sensor assembly mounted on said truck frame includes a plurality of sensor elements and said sensor assembly provides an interface between said truck frame and body when said body is in a lowered position such that said plurality of sensor elements taken as a whole provide an indication of the total weight of said truck body and when taken in groups comprising less than the whole and thereby provide an indication of fore-and-aft weight distribution as well as side-to-side weight distribution of the load carried by the truck body; and

processor means responsive to said groups of sensor elements of said pressure sensor assembly for detecting an imbalance of the weight carried by said truck body and signaling the truck operator in response thereto.

31. An apparatus as set forth in claim 1 wherein said body is pivotally mounted to said truck frame and said apparatus includes a distance sensor for providing signals to said processor means indicative of truck movement, said processor means including means responsive to said distance sensor and to said pressure sensor assembly for providing an output signal when said truck moves without the body in its fully lowered position.

32. An apparatus as set forth in claim 1 wherein said body is pivotally between raised and lowered positions and wherein said processor means includes 1) memory means for storing the tare weight of said truck body, 2) means responsive to the lowering of said truck body onto said pressure sensor assembly after the load carried by said body has been dumped for comparing the weight of said truck body with the tare weight in said memory, and 3) means for indicating the body is not fully empty when the weight of the body is greater than the tare weight of the body plus a predetermined constant.

33. An apparatus for processing data derived from the weight of the load carried by the body of a truck, said apparatus comprising:

a truck frame including a hinge assembly for pivotally supporting said truck body between raised and lowered positions;

a pressure sensor assembly mounted to said frame for supporting the entire weight of said body in its lowered position and providing pressure data representative of the weight of said truck body;

a distance sensor for providing distance data to said processor means indicative of truck movement;

a processor means for receiving said pressure data and detecting a monotohic change in the weight of said truck body and formulating data indicative of truck condition in response to said pressure data and its monotohic change; and

said pressure means including first means responsive to said pressure data for detecting said truck body raised off said pressure sensor assembly and second means responsive to said first means (1) and said distance data for providing an output signal when said truck moves with said body raised off said pressure sensor assembly.

34. An apparatus for processing data derived from the weight of the load carried by the body of a truck, said apparatus comprising:

a truck frame including a hinge assembly for pivotally supporting said truck body between raised and lowered positions;

a pressure sensor assembly mounted to said frame for supporting the entire weight of said body in its lowered position and providing pressure data representative of the weight of said truck body;

a processor means for receiving said pressure data and detecting a monotohic change in the weight of said truck body and formulating data indicative of such condition in response to said pressure data and its monotohic change; and

said processor means including 1) memory means for storing the tare weight of said truck body, 2) means responsive to the lowering of said truck body onto said pressure sensor assembly after the load carried by said body has been dumped for comparing the weight of said truck body with the tare weight in said memory, and 3) means for indicating the body is not fully empty when the weight of the body is greater than the tare weight of the body plus a predetermined constant.

35. An apparatus for determining the remaining weight capacity of a body carried on a truck frame which is loaded by the bucket of a loader and for indicating when the weight of the material in a full average bucket is more than the remaining weight capacity of the body, said apparatus comprising in combination:

a truck frame including a hinge assembly;

a truck body pivotally mounted to said truck frame at said hinge assembly, said truck body being pivotally movable on said frame between lowered and raised positions;

a pressure sensor assembly mounted to said frame for supporting the entire weight of said body in its lowered position and providing pressure data representative of the weight of said truck body;

a processor means for receiving said pressure data and determining the total weight of said truck body said processor means including;

1) memory means for storing data indicative of a predetermined maximum weight capacity for said truck body, 2) detection means responsive to incremental increases in the total weight of said truck body for determining the approximate weight of material added by a bucket, 3) comparison means responsive to said memory, processor and detection means for determining if the total weight minus said predetermined maximum weight for said truck body is a fraction of the approximate weight of material in said bucket, and 4) display means responsive to said comparison means for displaying the remaining weight capacity of said truck body.

36. An apparatus as set forth in claim 35 wherein said detection means includes;

first means for detecting a monotonic increase in the total weight of said truck body; and

second means for storing said increase.

37. An apparatus as set forth in claim 35 wherein said processor means includes means for isolating pressure data representing pressure spikes and means for recording the occurrence of a pressure spike, and means responsive to the recording means for delivering data to said display means indicative of the degree of road roughness.

38. An apparatus as set forth in claim 35 wherein said display means includes a display of the remaining weight capacity of said truck body as a percentage of the approximate weight of material carried by said bucket.

39. An apparatus as set forth in claim 38 wherein said display means comprises a series of light indicators representative of the approximate capacity of a bucket, said light indicators being relatively positioned such that each light represents a fractional portion of the capacity of the bucket.

40. An apparatus as set forth in claim 35 wherein said pressure sensor assembly is also a cushioning interface between said truck body and said truck frame.

41. An apparatus as set forth in claim 35 wherein said pressure sensor assembly includes a support means mounted on said truck frame, said support means directly supporting said truck body on said truck frame when said truck body is in a lowered position, said support means supporting the truck body in its lowered position in such a manner as to support the entire weight of the load along the interface between said truck frame and body with none of the weight of the load transferred to the truck frame via said hinge assembly.

42. An apparatus as set forth in claim 35 wherein said hinge assembly has body and frame portions and also has means for decoupling said body and frame portions when said truck body is moved to its lowered position such that the entire weight of said truck body is communicated to said truck frame through said pressure sensor assembly.

43. An apparatus as set forth in claim 35 wherein said pressure sensor assembly comprises at least one length of resilient tubing positioned on a beam of said truck frame wherein said resilient tubing provides an interface between said truck body and said truck frame for communicating the entire weight of said body to said frame when said body is in its lowered position.

44. A system for minimizing the hauling time of a plurality of trucks between load and dump sites, said system comprising:

an on-board weighing device on each of said plurality of trucks said on-board weighing device providing signals indicative of body weight;

first transceiver means mounted to each of said plurality of trucks;

processor means mounted to each of said plurality of trucks and each processor means operatively coupled to one of said first transceiver means and one of said on-board weighing devices for receiving said signals from said pressure sensor assembly, processing said signals and transmitting data signals indicative of the truck's hauling status by way of said transceiver; and

a stationary processor means including second transceiver means for communicating with said first transceiver means, said stationary processor means receiving said data signals from each of said plurality of processor means mounted to said plurality of trucks, said data signals identifying the truck and its hauling status.

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45. A system as set forth in claim 44 wherein said on-board weighing device includes a pressure sensor assembly mounted on the frame of the truck and supporting the body of the truck uniformly along an interface between the truck body and frame.

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46. A system as set forth in claim 44 wherein said stationary processor means includes 1) first means for calculating in response to said data signals an average load time for each loader, 2) second means responsive to said data and said first means for calculating the current load delay time for each loader, 3) third means for identifying the loader with the minimum load delay time, 4) fourth means for forming data for transmission by said second transceiver means, said data identifying a particular truck and the loader with the minimum load delay time; and each of said plurality of processor means mounted to said plurality of trucks includes fifth means responsive to data received from said fourth means by said first transceiver for displaying the number of the loader identified by the data to the operator of the truck identified by the data.

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47. A system as set forth in claim 44 wherein said pressure sensor assembly includes tubings which forms the interface between each of said body and frame of said trucks.

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48. A system as set forth in claim 44 wherein said stationary processor means includes memory means for archiving data from said trucks.

49. A system as set forth in claim 44 wherein said processor means generates data signals for transmission in

response to said signals from said pressure sensor assembly which are indicative of whether a particular truck is dumping its load, beginning loading of a new load or in transit between load and dump sites.

50. A system as set forth in claim 44 wherein said stationary processor means includes memory means for archiving said data signals from each of said plurality of processors in groups firstly identifiable with individual trucks and secondly identifiable with types of trucks.

51. A system as set forth in claim 47 wherein the data base formed by the data archived in said memory means is used by said stationary processor means to generate data for controlling the movement of said trucks by transmitting said control data to for reception by said first transceivers.

52. A method for detecting and recording the degree of road roughness for an off-road, heavy-duty truck, said method comprising the steps of:

periodically calculating the force of said truck body on said truck frame;

storing said force calculations;

periodically comparing a selected one of said force calculations with other stored force to determine if said one of said force calculations is a force spike;

counting the force spikes; and

deriving from the total count of force spikes an indication of the degree of road roughness and displaying said indication.

53. A method as set forth in claim 52 wherein the pressure of said truck body on said truck frame is calculated with the truck body fully lowered onto the truck frame.

54. A method as set forth in claim 52 wherein the force of said truck body on said truck frame is provided by a pressure sensor interfaced between the truck body and frame to communicate a predetermined portion of the weight of said truck body to said truck frame.

55. A system for measuring the degree of tire use by a vehicle which hauls material in a dump body pivotally mounted to the frame of said vehicle, said apparatus comprising;

distance means for measuring the distance traveled by said vehicle and providing distance data;

an on-board weighing device for measuring the total weight of a load of material hauled by said vehicle and providing weight data and for providing data indicative of the beginning and ending of a haul cycle;

storage means responsive to said distance means and said on-board weighing device for accumulating the distance and weight data; and

stationary processor means for receiving said weight and distance data, said stationary processor means including 1) means for identifying the elapsed time, total distance and the weight for each haul cycle, 2) means for multiplying the total distance and weight for each haul cycle to provide a sum, 3) means for dividing said sum by the elapsed time for each haul cycle, and 4) means for displaying the value resulting from the multiplying means thereby indicating a standard for the degree of tire wear of the truck tires as a function of the vehicle's load.

56. An apparatus as set forth in claim 55 wherein said on-board weighing device includes a pressure sensor assembly mounted on said frame of said vehicle which fully supports the weight of said load when said body is in its fully lowered position.

57. An apparatus as set forth in claim 56 wherein said body is pivotally mounted to said frame by way of a hinge assembly such that said body is fully supported by said pressure sensor assembly when said truck body is in a fully lowered position.

58. An apparatus for use in connection with an off-road, heavy-duty truck wherein said apparatus records vital statistics of the truck in connection with an identifier number entered into the apparatus by the truck operator, said apparatus comprising:

a processor including memory means;

means coupled to said processor for entering an identifier number and in response thereto identifying a portion of said memory means;

measuring means for providing data indicative of hauling parameters of said truck;

said processor means responsive to said measuring means for 1) receiving said data indicative of hauling parameters, 2) manipulating said data and 3) routing said manipulated data to locations within said portion of said memory identified by said entering means;

detecting means responsive to said entering means for detecting changes in the identifier number; and

means responsive to said detecting means for transferring from memory the manipulated data in said portion of memory when a change of the identifier number has occurred.

59. An apparatus as set forth in claim 58 wherein said truck has a body pivotably mounted on a truck frame, said measuring means including:

a pressure sensor assembly supporting the entire weight of said body on said truck frame when said body is in a

fully lowered position and said pressure sensor assembly providing pressure data representative of the weight of said truck body; and

said memory means including data indicative of a predetermined maximum weight for said truck body.

60. An apparatus for identifying an overload condition in off-road, heavy-duty trucks having bodies mounted to the truck frames by hinge assemblies for movement between lowered and raised positions, said apparatus comprising, in combination:

a sensor assembly mounted on said truck frame and supporting a predetermined portion of the weight of said truck body on said truck frame when said truck body is in said lowered position, said sensor assembly responding to the weight of said body to provide a signal indicative of the entire weight of said body;

a means for transferring said signal to a remote, off-board processor;

said remote off-board processor means responsive to said signal and including memory means for storing a predetermined maximum load capacity for said truck body; and

said processor means including means for 1) determining a weight of said truck body from the signal of said sensor assembly indicative of the weight of the load, 2) comparing the weight with the predetermined maximum load capacity, and 3) generating an output signal if the weight is greater than the predetermined maximum load capacity.

61. An apparatus as set forth in claim 60 including means for displaying the weight of said truck body.

62. An apparatus as set forth in claim 60 including means in said processor means for accumulating the total number of times an output signal is generated indicating an overload of the truck.

63. An apparatus for measuring and manipulating various hauling and loading parameters for an off-road, heavy duty truck having a body, a frame and front and rear axles, said apparatus comprising:

a first weighing device on said truck for measuring a first force of said truck body on said truck frame and providing data representative of said first force;

a second weighing device on said truck for measuring a second force of said truck body on said truck frame and providing data indicative of said second force;

a processor means responsive to said first and second weighing devices for determining the distribution of the weight of said truck body over the front and rear axles of said truck; and

display means responsive to said processor means for displaying the portions of the weight of said truck body carried by said front and rear axles.

64. An apparatus as set forth in claim 63 wherein said truck frame includes a hinge assembly and said truck body is pivotally mounted to said truck frame at said hinge assembly such that said truck body is pivotable between raised and lowered positions, said first weighing device supporting the entire weight of said truck body when said truck body is in its lowered position.

65. An apparatus as set forth in claim 64 wherein hydraulic cylinders connected between said truck frame and body move said truck body between said raised and lowered positions, said second weighing device sensing the pressure in the hydraulic fluid of said hydraulic cylinder.

66. An apparatus as set forth in claim 59 wherein said processor means finds the location of the center of gravity

of a loaded truck body on an imaginary line passing through the front and rear axle of said truck.

67. A method for measuring the load bearing on the front and rear axles of an off-road, heavy duty truck having a body connected to the truck frame by a hinge assembly for pivotal movement of the body about the hinge assembly by hydraulic cylinders, said method comprising the steps of:

weighing the truck body by a first means;

weighing the truck body by a second means;

determining from the weight measurements the location between the front and rear axles of a vertical plane including the center of gravity of said truck body; and

dividing the weight of the truck body between front and rear axles in the same ratio as the ratio of the horizontal distances from the front and rear axles to said vertical plane.

68. A method as set forth in claim 67 including the step of adding the predetermined tare weight bearing on the front and rear axles to the portions of the body weight bearing on the front and rear axles.

69. An apparatus for measuring and manipulating various hauling and loading parameters for an off-road, heavy duty truck having a body, a frame and front and rear axles, said apparatus comprising in combination:

hinge assemblies pivotally joining said truck frame and body;

a sensor assembly mounted on said truck frame and including a plurality of sensor elements, said sensor assembly supporting a predetermined portion of the weight of said truck body when said truck body is fully lowered on said truck frame;

said sensor assembly providing an interface between said truck frame and body when said body is in a lowered position such that said plurality of sensor elements taken as a whole provide an indication of the total weight of said truck body and when taken in groups comprising less than the whole provides an indication of fore-and-aft weight distribution as well as side-to-side weight distribution of the load carried by the truck body; and

processor means responsive to said sensor assembly for detecting an imbalance of the weight carried by said truck body and signalling the truck operator in response thereto.

70. A method of determining the weight carried by a heavy duty earth-moving vehicle having at least one hoist cylinder for moving the load-carrying body of the vehicle between a lowered position for loading and a raised position for hauling, said method comprising the steps of:

activating said hoist cylinder to raise said body to its hauling position;

sensing the pressure in said hoist cylinder and determining from said pressure the force necessary to lift said body to its hauling position;

estimating the relative position of the center of gravity of said load between the front and rear axles of said vehicle; and

determining the total weight of the load from the force associated with said hoist cylinder and the estimated position of the load's center of gravity.

71. A method as set forth in claim 70 including the step of determining the relative axial loads on said vehicle from the total of the load carried by said body.

72. A method as set forth in claim 70 including the step of determining the relative position between front and

rear axles of said hoist cylinder before determining the total weight of the load carried by said body.

73. A stationary platform scale for placement on an approximately level ground surface, said scale comprising, in combination:

a first planar plate;

a plurality of flexible tubing laid on said first planar plate with each tubing having first and second ends;

a second planar plate positioned to rest atop said plurality of flexible tubing, said second planar plate extending to fully cover said plurality of flexible tubing;

a plurality of pressure sensors each secured to one of said first or second ends of each of said plurality of flexible tubing for providing pressure data indicative of a weight present on said second planar plate;

said second planar plate having a lower surface for direct contact with each of said plurality of flexible tubing wherein said lower surface includes a calibration plate to ensure a known surface area of contact between said plurality of flexible tubing and said second planar plate; and

means for gathering all the data from said plurality of pressure sensors and determining a weight present on said second planar plate.

74. A stationary platform scale as set forth in claim 73 including stabilization means coupling said first and second planar plates to retard movement parallel to the planes of said plates while simultaneously allowing the plates to move relative to one another in a direction normal to the planes of said plates.

75. In a system for controlling the routing of a fleet of vehicles composed of distinct groups to a plurality of

possible locations, a method for monitoring and commanding vehicle movement comprising the steps of:

sensing the weight and change in weight of the load carried by each vehicle and formulating raw data representative of said weight and said change in weight;

transferring said raw data to a central location;

cataloging raw data at said central location from each vehicle and combining said raw data from selected vehicle groups to provide collective data indicative of group performance; and

analyzing said raw and collective data to provide data commands for transfer to selected vehicles.

76. In a system for controlling the routing of a fleet of vehicles composed of distinct groups to a plurality of possible locations, an apparatus for monitoring and commanding vehicle movement comprising, in combination:

means on-board each of said vehicles for sensing a change in load carried by said vehicle and forming data representative of said change;

means on-board each of said vehicles for transmitting said data;

a central computer for receiving said data from each of said vehicles and 1) cataloging said data to provide averages for each vehicle, 2) formulating a data base for each of said groups from said averages, 3) analyzing said averages from each of said vehicles and each of said groups and 4) forming control data in response to said analysis; and

transmitting means coupled to said central computer for transmitting said control data to selected trucks.

77. In a system as set forth in claim 76 including repeater transmitters strategically located along the routes of said fleet of vehicles and each repeater transmitter

receiving said data from vehicles in its vicinity and re-transmitting said data to said central computer such that the re-transmitted data identifies the approximate location of said vehicles.

78. In a system as set forth in claim 76 wherein said control data includes data designating load and dump sites and each of said vehicles includes display means responsive to said control data for displaying the load or dump site to the vehicle operator.

79. In a system as set forth in claim 76 wherein each of said vehicles is loaded with material by a loader and said data from said on-board means provides data indicative of loader performance such that said central computer includes a data base of loader performance based on said data.

80. In a system as set forth in claim 76 wherein said vehicles include a pivotal body mounted on a frame for movement between raised and lowered positions and said on-board means includes a pressure sensor assembly mounted to said frame for supporting the entire weight of said body in its lowered position and providing said data indicative of a change in load.

81. In a system as set forth in claim 76 wherein said on-board means includes means for detecting a monotonic increase in the load carried by said vehicle.

82. In a system as set forth in claim 80 wherein said pressure sensor assembly is mounted on the frame of said vehicle and is continuous along the interface between said truck body and truck frame when said body is moved to its lowered position.

83. In a system for controlling the routing of a fleet of dump-body trucks composed of distinct groups to a plurality of possible locations and including a central computer for receiving data from said trucks and issuing commands to said trucks, an apparatus on-board each of said trucks comprising, in combination:

a pressure sensor assembly mounted to the frame of said truck for supporting the entire weight of the body of said truck in its lowered position, said pressure sensor assembly providing pressure data indicative of the weight of said body;

a processor means on-board each of said trucks for receiving said pressure data and detecting a monotonic change in the weight of said body, and providing output data indicative of truck condition; and

transmitter means on-board each of said trucks for receiving said output data from said processor means and transmitting said output data to said central computer for further processing.

84. In the system set forth in claim 83, said central computer including means for receiving said output data and formulating a data base for each truck and each group of trucks, said central computer also including means responsive to said data base for providing control data to a second transmitter means operatively coupled to said central computer.

85. In the system set forth in claim 84, a receiver means on-board each of said trucks for receiving said control data and delivering it to said processor means.

86. In the system set forth in claim 85, said processor means including means responsive to said control

data to provide display data to an on-board display means for use by the truck operator.

87. An apparatus for measuring the weight of the load carried by the body of a truck, said apparatus comprising, in combination:

a truck body and a truck frame;

means for coupling said body to said frame to inhibit side-to-side or fore-to-aft movement of said body with respect to said frame but allowing limited vertical movement; and

a pressure sensor assembly supporting a predetermined portion of the weight of said body along an interface between said body and frame such that the weight of said body is transferred to said frame uniformly along said interface.

88. An apparatus as set forth in claim 87 wherein said pressure sensor assembly includes a signal output indicative of pressure and said apparatus includes a processor means for receiving said signal output.

89. An apparatus as set forth in claim 88 wherein said processor means includes means for detecting a monotonic change in the weight of said truck body and formulating data indicative of truck condition in response to said pressure data and its monotonic change.

90. An apparatus for measuring the weight of a truck body and its load, comprising, in combination:

a truck frame supporting said truck body;

a pressure sensor assembly mounted on said truck frame and positioned along an interface between said truck body and frame for supporting a predetermined portion of the total weight of said truck body such that said assembly

distributes said predetermined portion of the total weight of said truck body in a substantially uniform manner along said interface, said assembly providing a plurality of output signals indicative of the pressure at said interface between said body and frame;

means on-board said truck and responsive to said plurality of output signals for formulating a single indication of the weight of said truck body and its load; and

a display responsive to said means for indicating the weight of the load carried by said body.

91. An apparatus as set forth in claim 90 wherein said means includes means for subtracting a predetermined weight representative of the tare weight of said body from said single indication of the weight of said truck body and its load in order to provide an indication to said display of the net weight of said truck body.

92. An apparatus as set forth in claim 90 wherein said plurality of output signals from said pressure sensor assembly are fluid pressures and said means is a mechanical adder responsive to said fluid pressures for activating a visual signal in said display indicative of the weight of the load carried by the truck body.

93. An apparatus as set forth in claim 90 wherein said plurality of output signals from said pressure sensor assembly are electrical signals and said means is an electronic adder responsive to said plurality of electrical signals for activating a visual signal in said display indicative of the weight of the load carried by the truck body.

94. An apparatus as set forth in claim 92 wherein said mechanical adder includes a plurality of chambers, one for each output signal from said pressure sensor assembly, wherein said chambers have a piston assembly interconnecting the chambers in a manner which creates a fluid pressure in one of the chambers which is the sum of the fluid pressures.

95. A system for measuring the weight of a vehicle body and its load and transferring the measurement to a remote stationary site, said system comprising, in combination:

a vehicle frame for supporting said body;

a pressure sensor assembly mounted on said truck frame and positioned along an interface between said truck body and frame for supporting a predetermined portion of the total weight of said truck body such that said assembly distributes said predetermined portion of the total weight of said truck body in a substantially uniform manner along said interface, said assembly providing at least one output signal indicative of the pressure at said interface between said body and frame;

means remote from said vehicle for receiving at least one output signal and formulating an indication of the weight of said body and its load; and

coupling means joining said pressure sensor assembly and said remote means for transferring said at least one output signal from said assembly to said remote site.

96. A system according to claim 95 wherein said at least one output signal from said pressure sensor assembly is fluid under pressure and said remote means is a pressure responsive device for providing for providing a visual indication indicative of the weight of said body and said coupling means is a conduit for communicating the fluid under pressure from said assembly to said pressure responsive device remote from the vehicle.

97. A system according to claim 95 wherein said at least one output signal from said pressure sensor assembly is an electrical signal and said remote means is a circuit response to said electrical signal when received via said coupling means.

98. A system according to claim 97 wherein said pressure sensor assembly comprises liquid-filled tubing.

99. In a system utilizing pressurized tubing, an apparatus for terminating an end of said tubing and for insuring the termination is leak-proof under high pressures, said apparatus comprising, in combination:

an end clamp located at the end of said tubing and comprising first, second and third positions;

said third position of said end clamp located inside said tubing while said first and second portions fit over the outside of said tubing so as to sandwich said tubing and third position;

means for joining said first, second and third positions of said clamp with said tubing including a plurality of screws holding said portions together and also bonding material joining the tubing to said portions so as to totally seal the end of said tubing; and

a collar surrounding said tubing at an area proximate the end of said tubing but rearward of said clamp, said collar having a central bore for receiving said tubing and restraining said tubing such that the radial forces with respect to the longitudinal axis of said tubing are at least partially absorbed by said collar and thereby attenuated at the longitudinal interface between said tubing and said clamp.

100. In a system for monitoring hauling parameters of a vehicle with a dump body, an on-board apparatus comprising, in combination:

a sensor mounted on said body and responsive to the pivotal position of said body for providing an output signal indicative of the position of said body, said sensor being totally encapsulated in a housing in order to prevent ambient conditions from reducing the responsiveness of said sensor

a processor for receiving said output signal from said sensor and responding to said signals in a predetermined manner; and

means communicating said output signal from said sensor to said processor wherein said means includes an output port in said housing which maintains the sensor in isolation from its ambient environment.

~~101~~ 92. The on-board apparatus as set forth in claim ~~100~~ 91 wherein said sensor is a mercury switch.

Add ~~A11~~ A2

add B1

Sub D21

~~add F13~~

add F14